

Mercury Control Test Results for Taconite Plants



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April 14, 2009





Coordinated Mercury Research Effort (2008-2009)



Participants:

DNR: M. Berndt, J. Folman, T. Bavin, J. Goodman, J. Engesser

EERC: D. Laudal, T. Bartley, J. Pavlish, Y. Zhuang, G. Dunham

Laboratories: Cebam, Inc., Univ. of Minnesota Geology Dept

Host Companies: Keewatin Tac., Hibbing Tac., Minntac, United Tac.,

Arcelor-Mittal

Funding:

IOCR = Iron Ore Coop. Research

ECR = Environmental Coop. Research

MPCA= Minnesota Poll. Cont. Agency

IMA= Iron Mining Association

Keewatin Taconite

Hibbing Taconite

Minntac

United Taconite

Arcelor Mittal Steel

Northshore Mining



Coordinated Hg Research Effort



- Conduct Primary Hg Research

Geochemistry laboratory

Cebam, Inc: Hg analysis in solids and water

U of MN-Geochem Lab: IC, ICP-MS

- Coordinate Research Activities by Other Groups

Prioritize research

Match funding resources to research groups

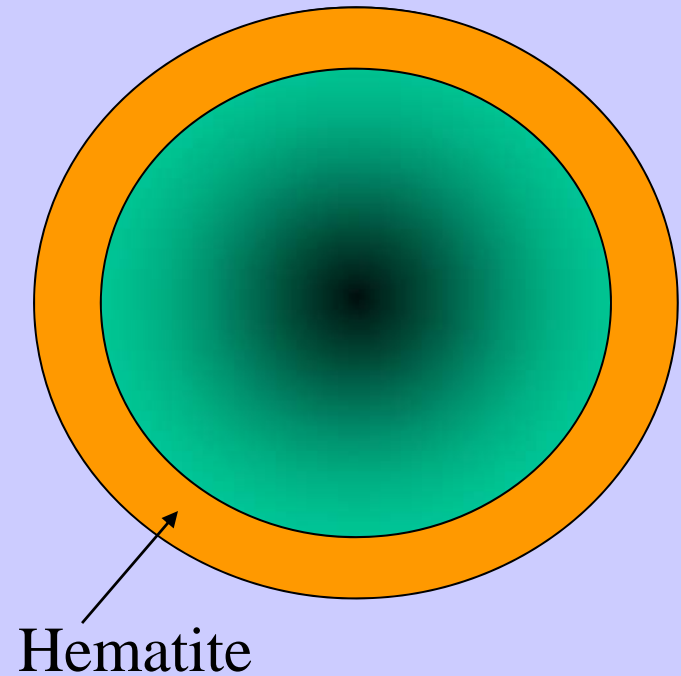
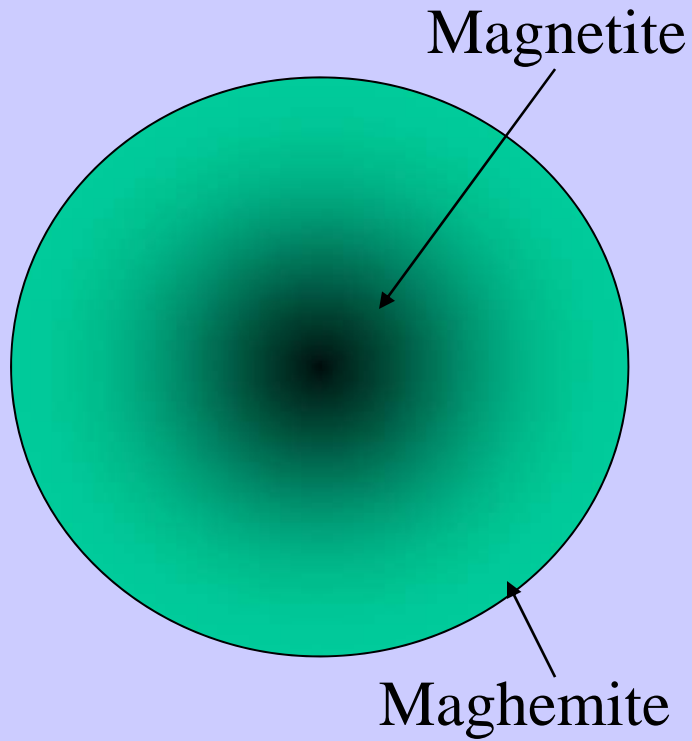
Conduct independent and group research projects

Communicate results

Major Hg Control Tests:

- (1) Hibbing Taconite (July, 2006)**
- (2) United Taconite (September, 2006)**
- (3) Keewatin Slip-Stream Tests (April, 2007)**
- (4) Hibbing Taconite (May, 2007)**
- (5) Keewatin Taconite (Sept., 2007)**
- (6) Minntac (April, 2008)**
- (7) Arcelor Mittal (July, 2008)**
- (8) United Taconite (October, 2008)**

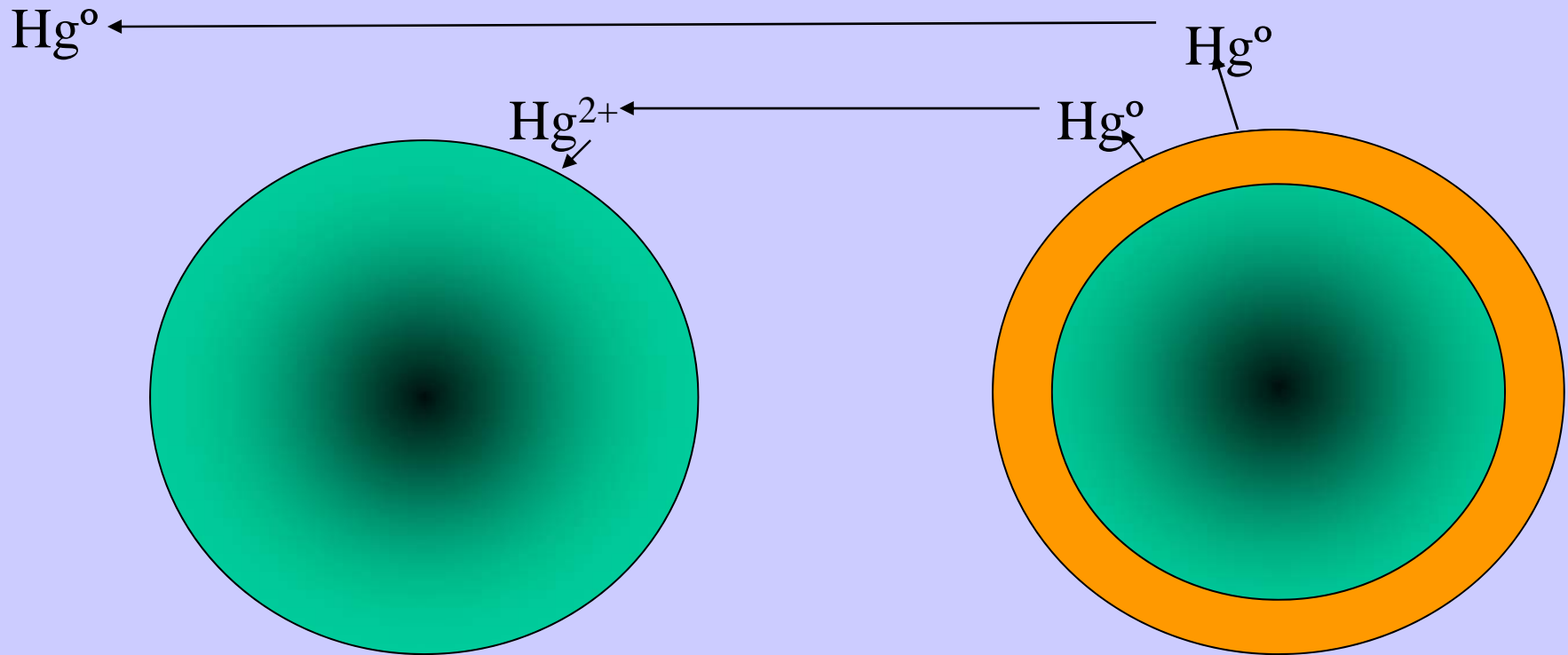
Mineralogy



PREHEAT ZONE

FIRING ZONE

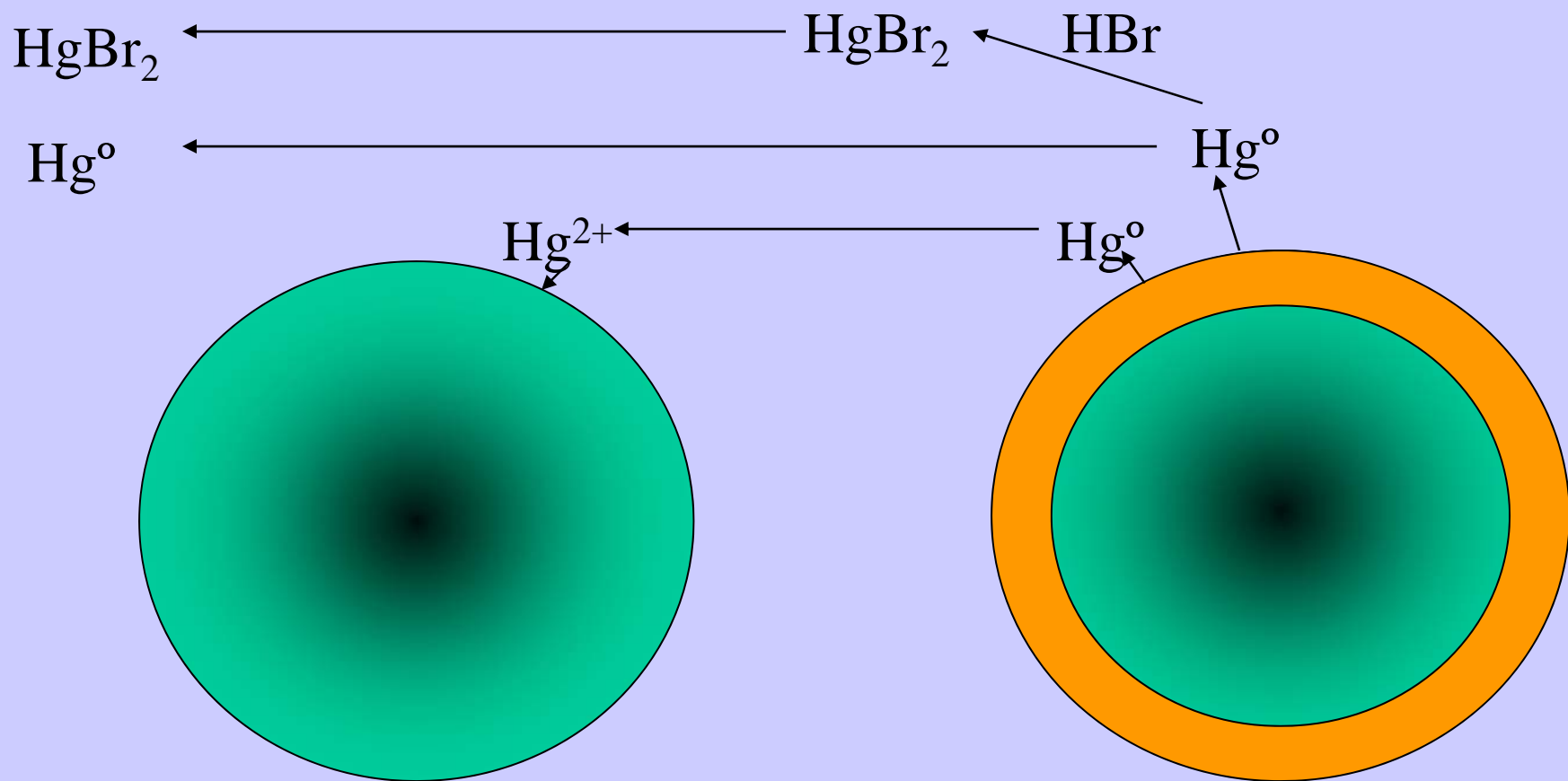
Mercury Reactions



PREHEAT ZONE

FIRING ZONE

Mercury Reactions: With HBr



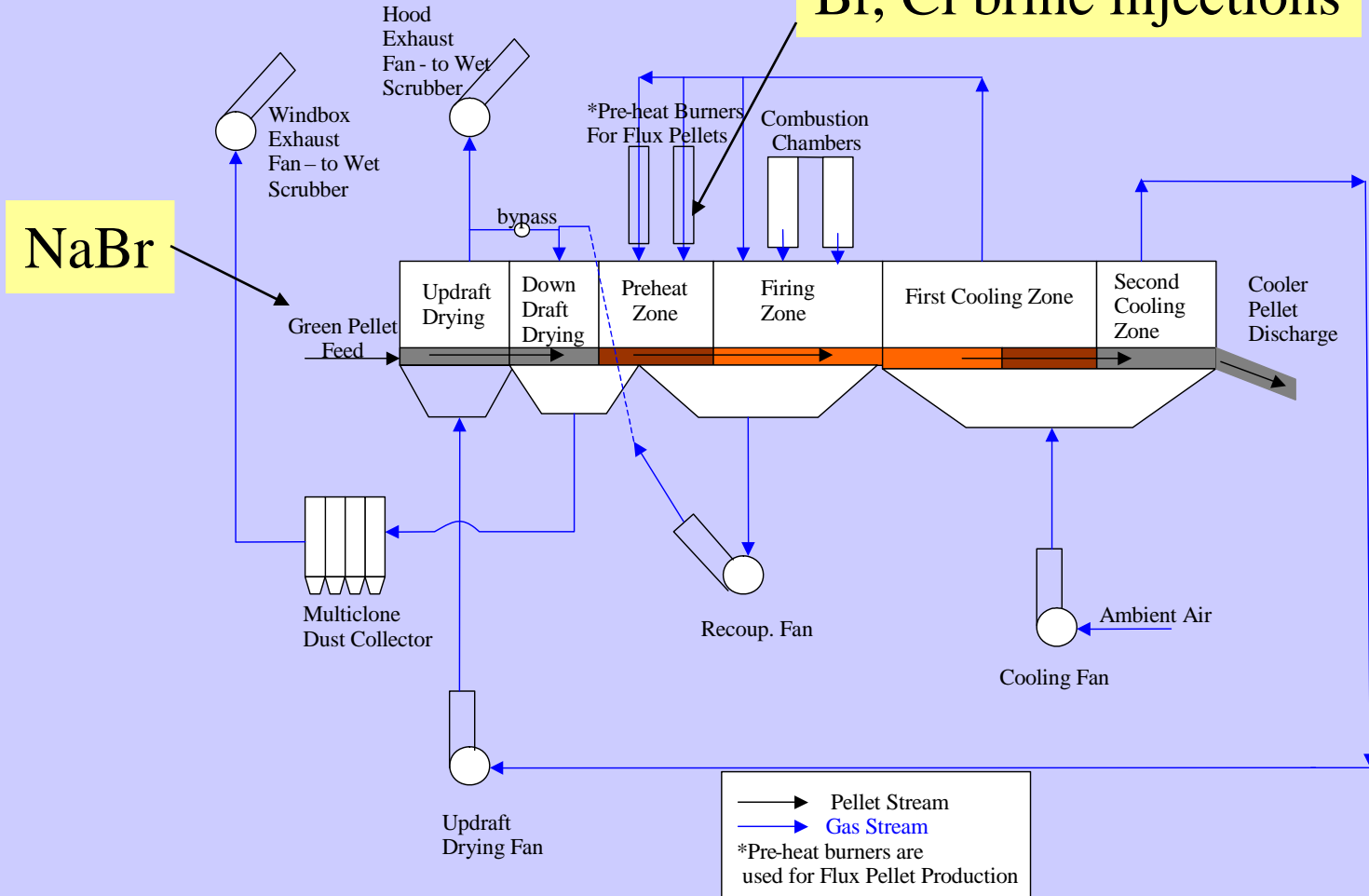
PREHEAT ZONE

FIRING ZONE

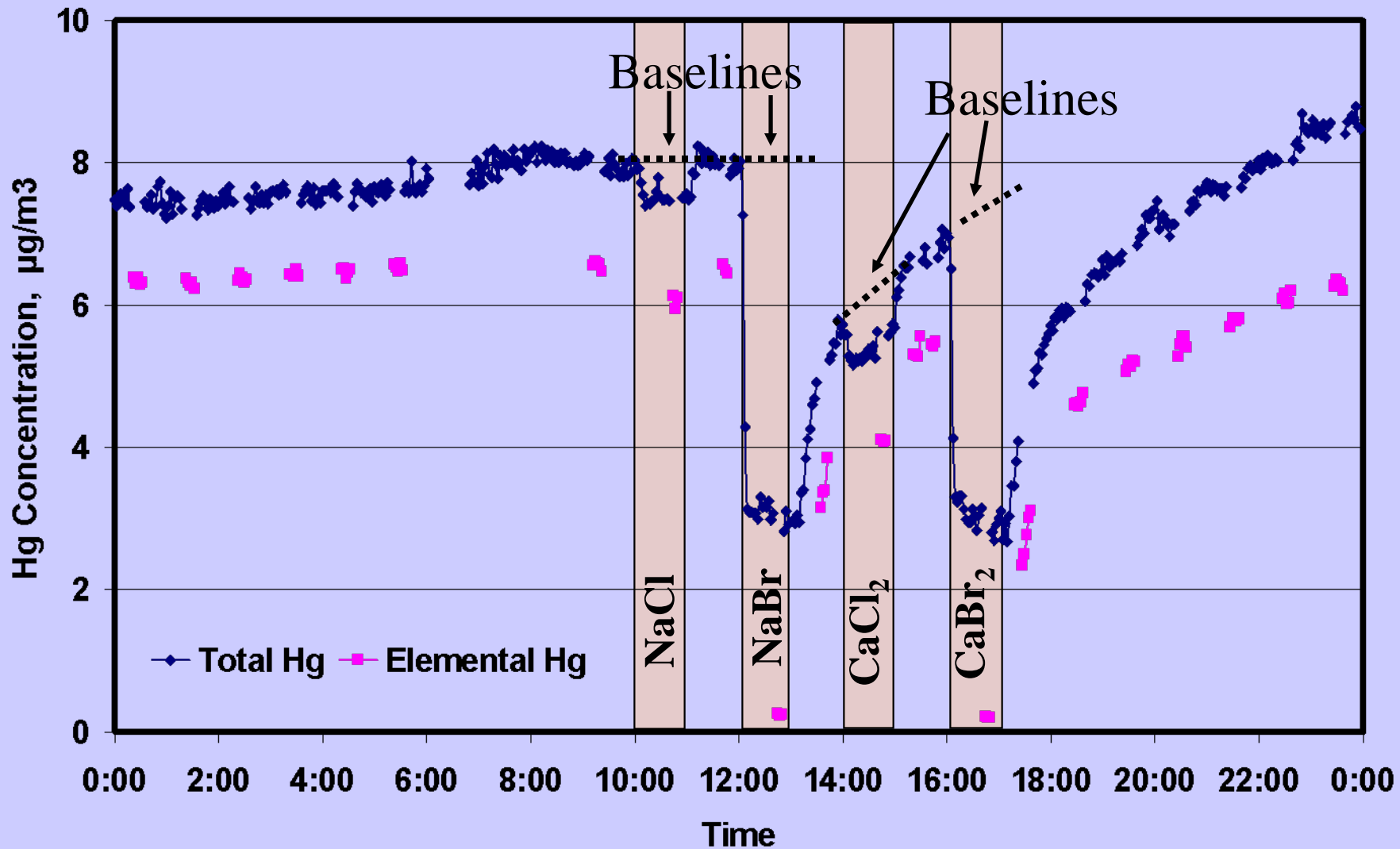
Hg tests at straight Grates

NaClO₂ to wet scrubber

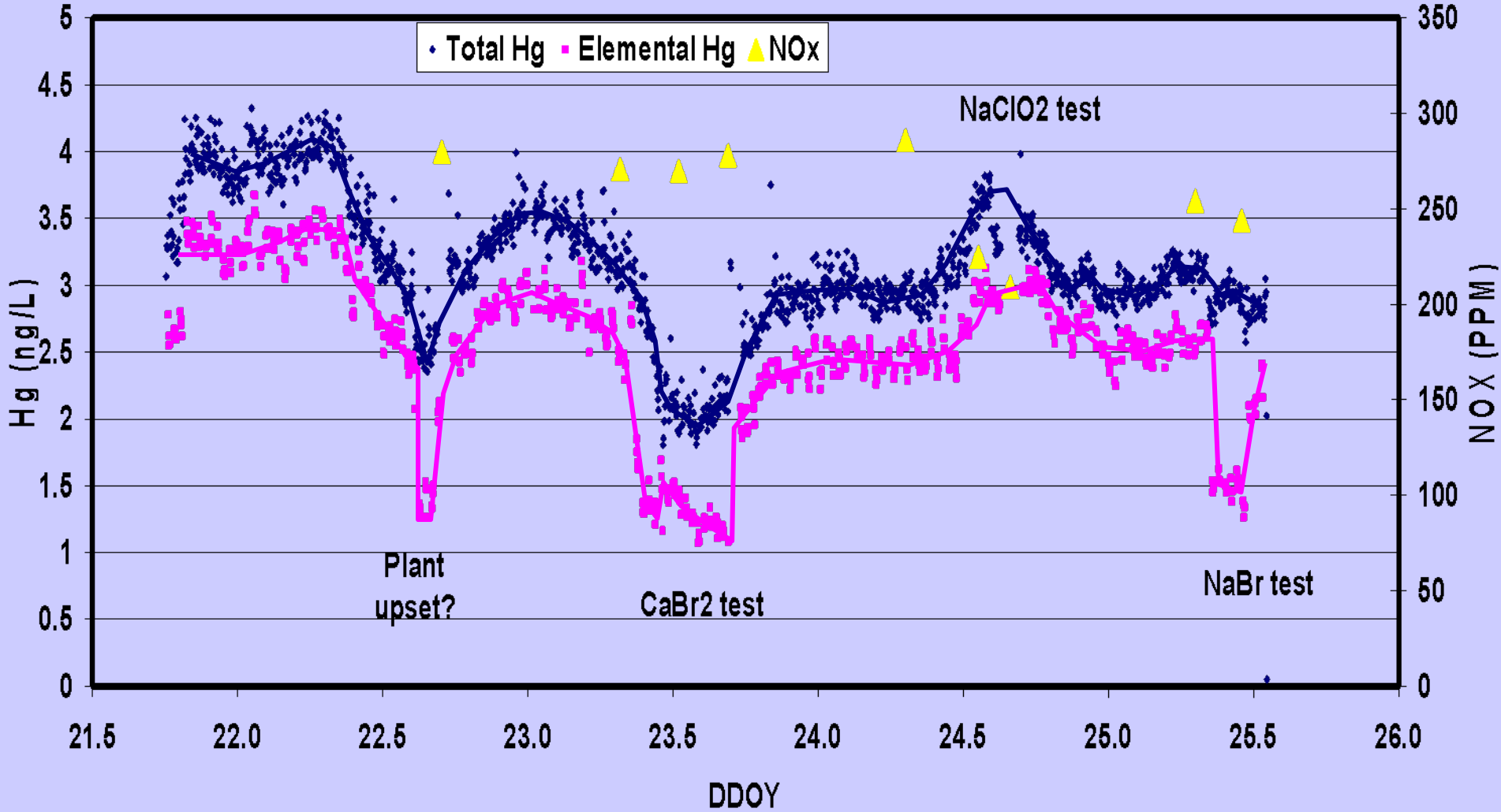
Br, Cl brine injections



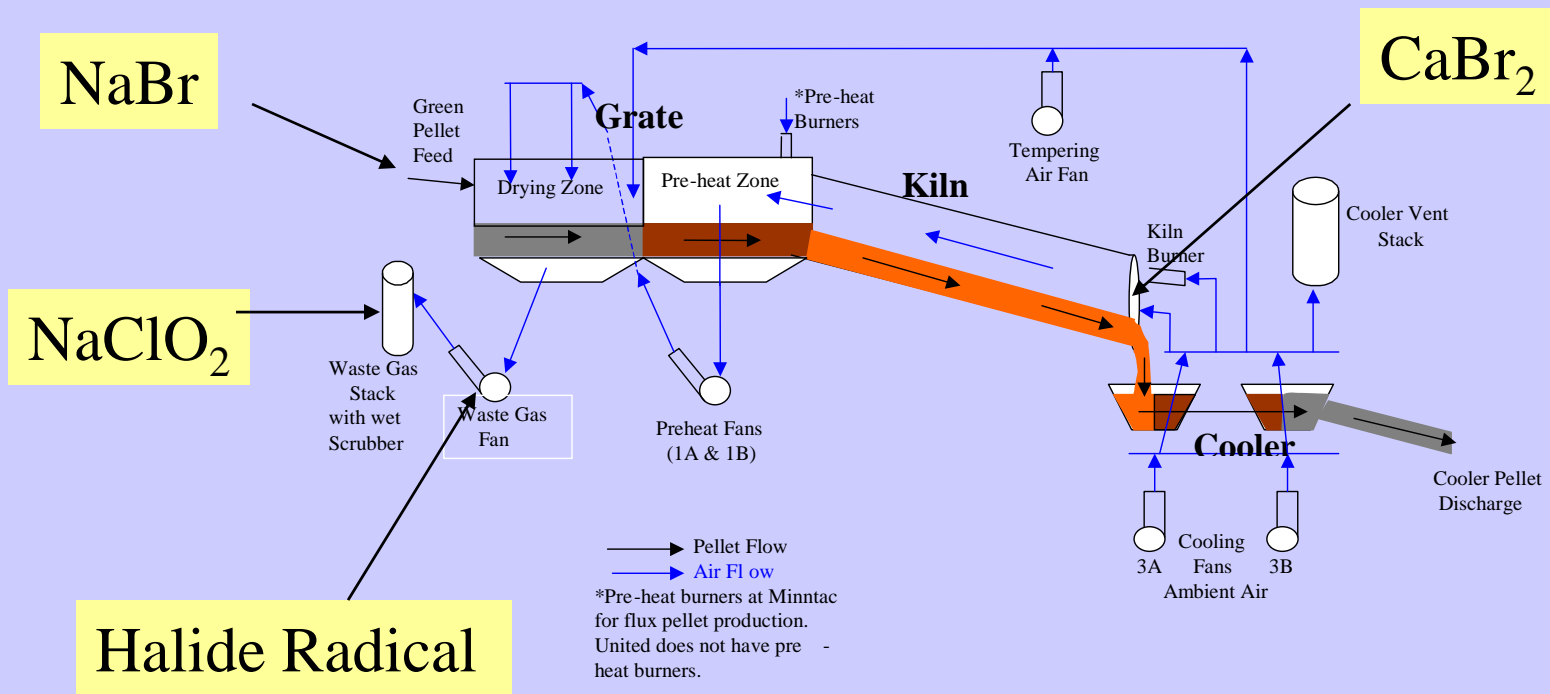
Focused halide injection at Hibbing Taconite



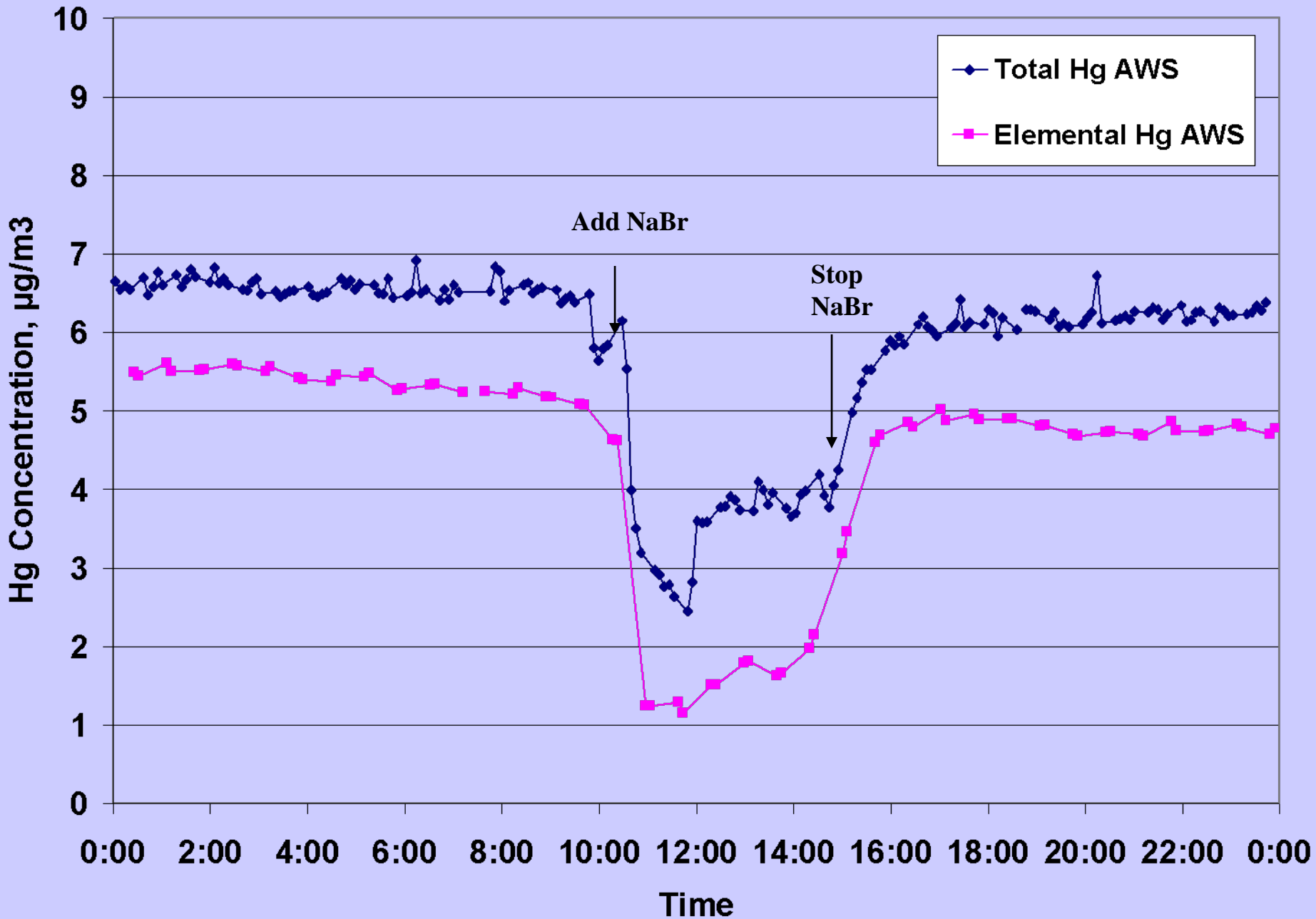
Hg reduction tests at Arcelor Mittal



Multiple testing at Grate Kilns



Keewatin Taconite Hg Control Test



CaBr₂ Injection Into Kiln Keewatin Taconite – Sept 26, 2007

◆ Total Hg AWS
■ Elemental Hg AWS

Hg Concentration, µg/m³

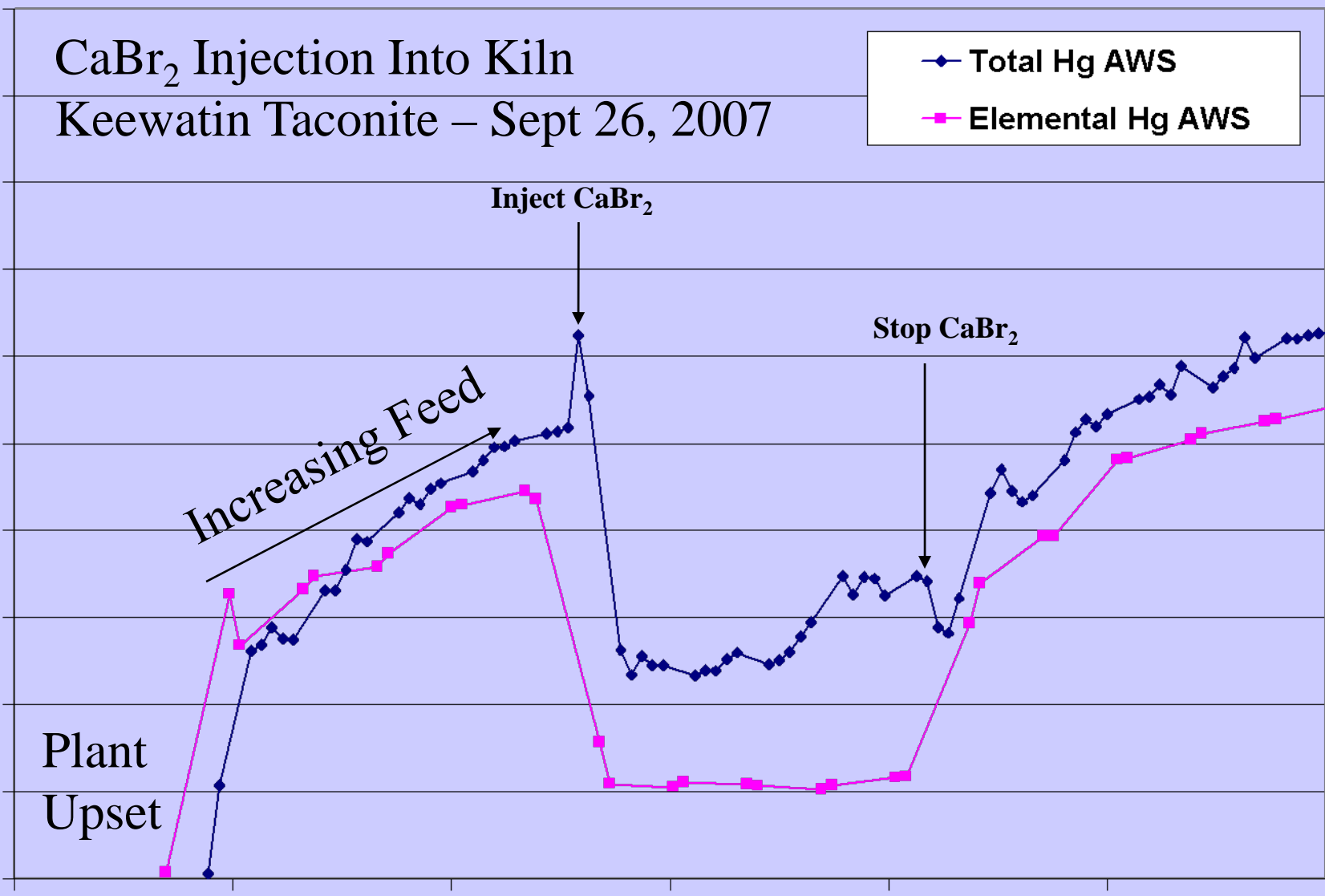
Increasing Feed

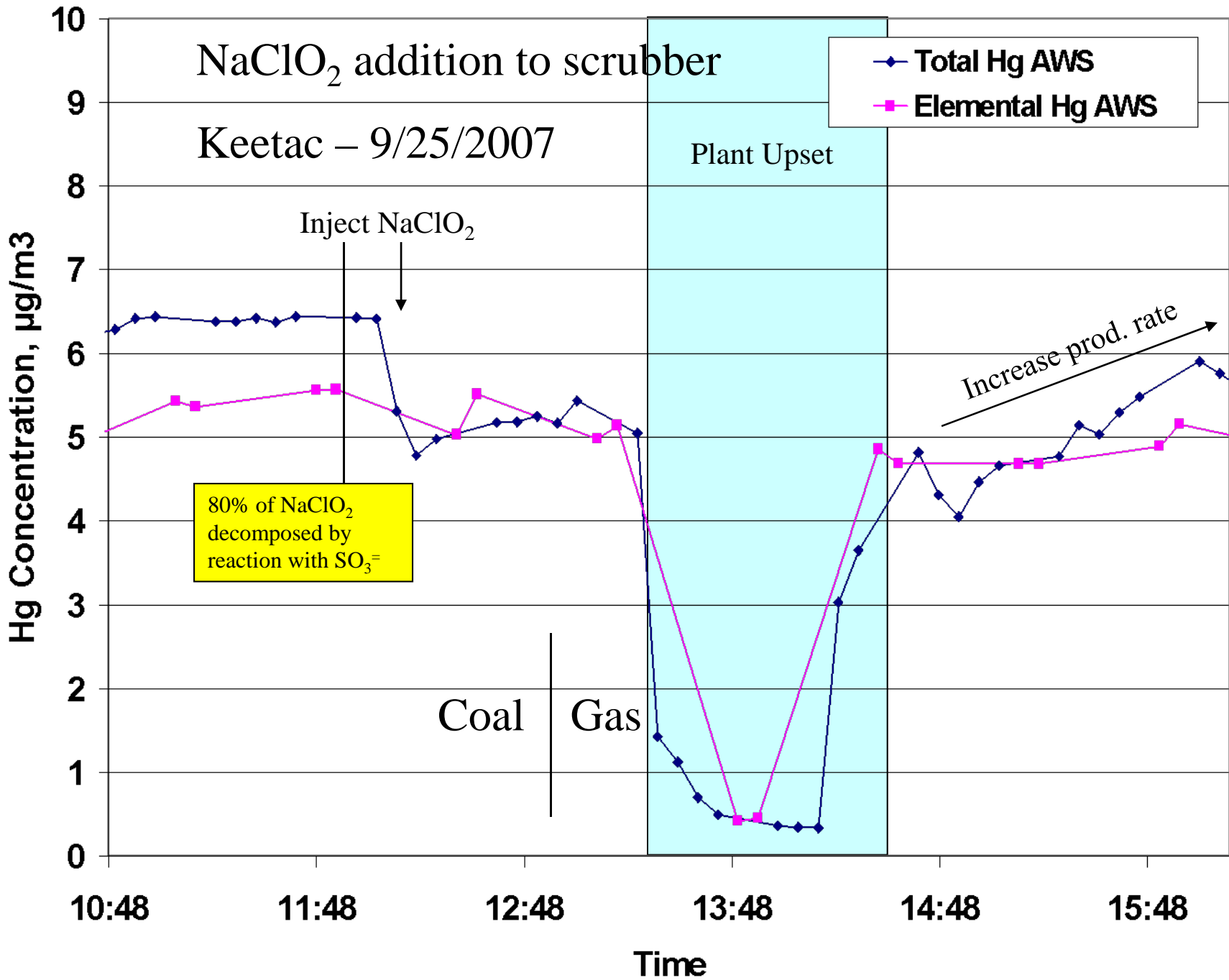
Inject CaBr₂

Stop CaBr₂

Plant
Upset

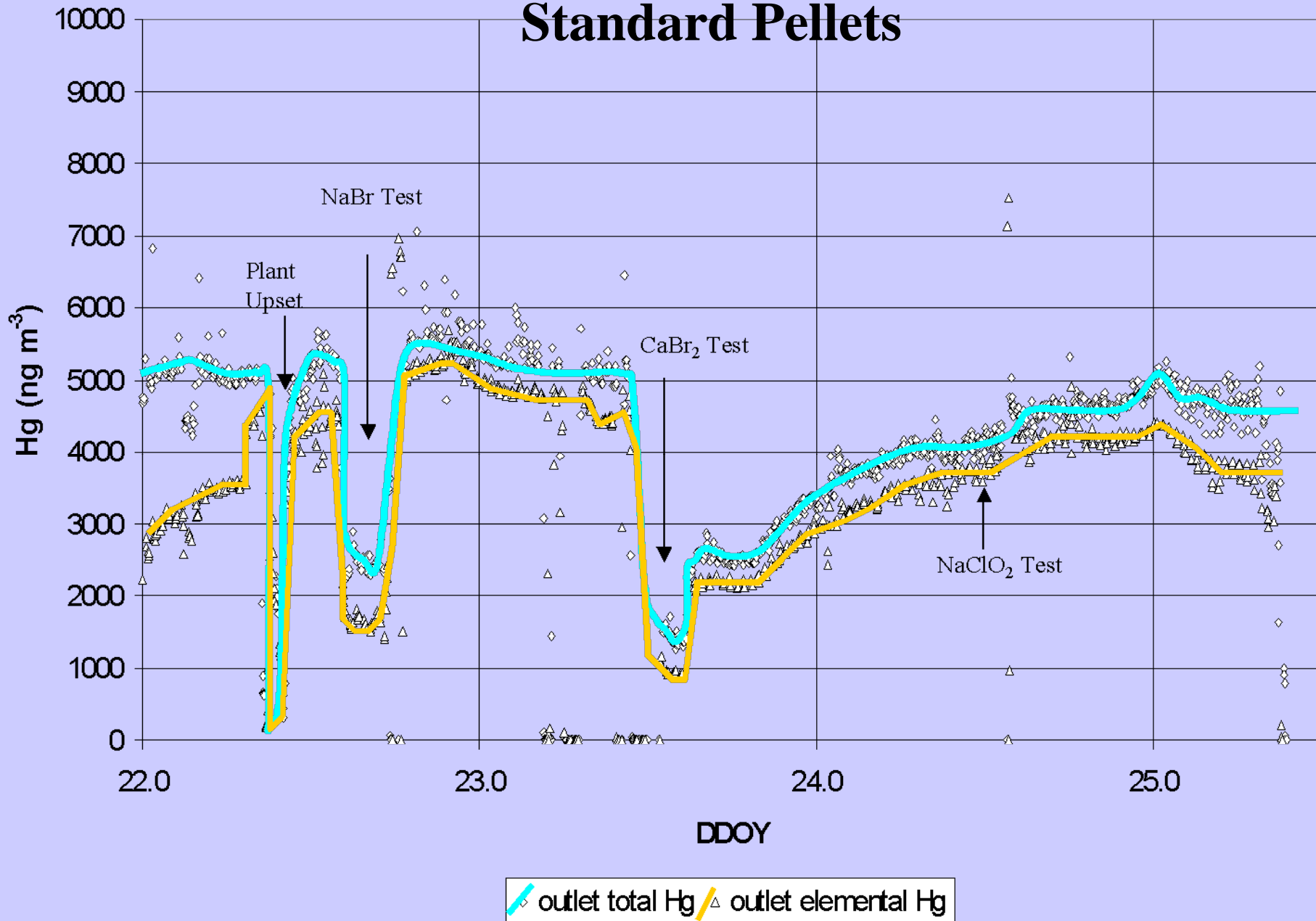
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Time



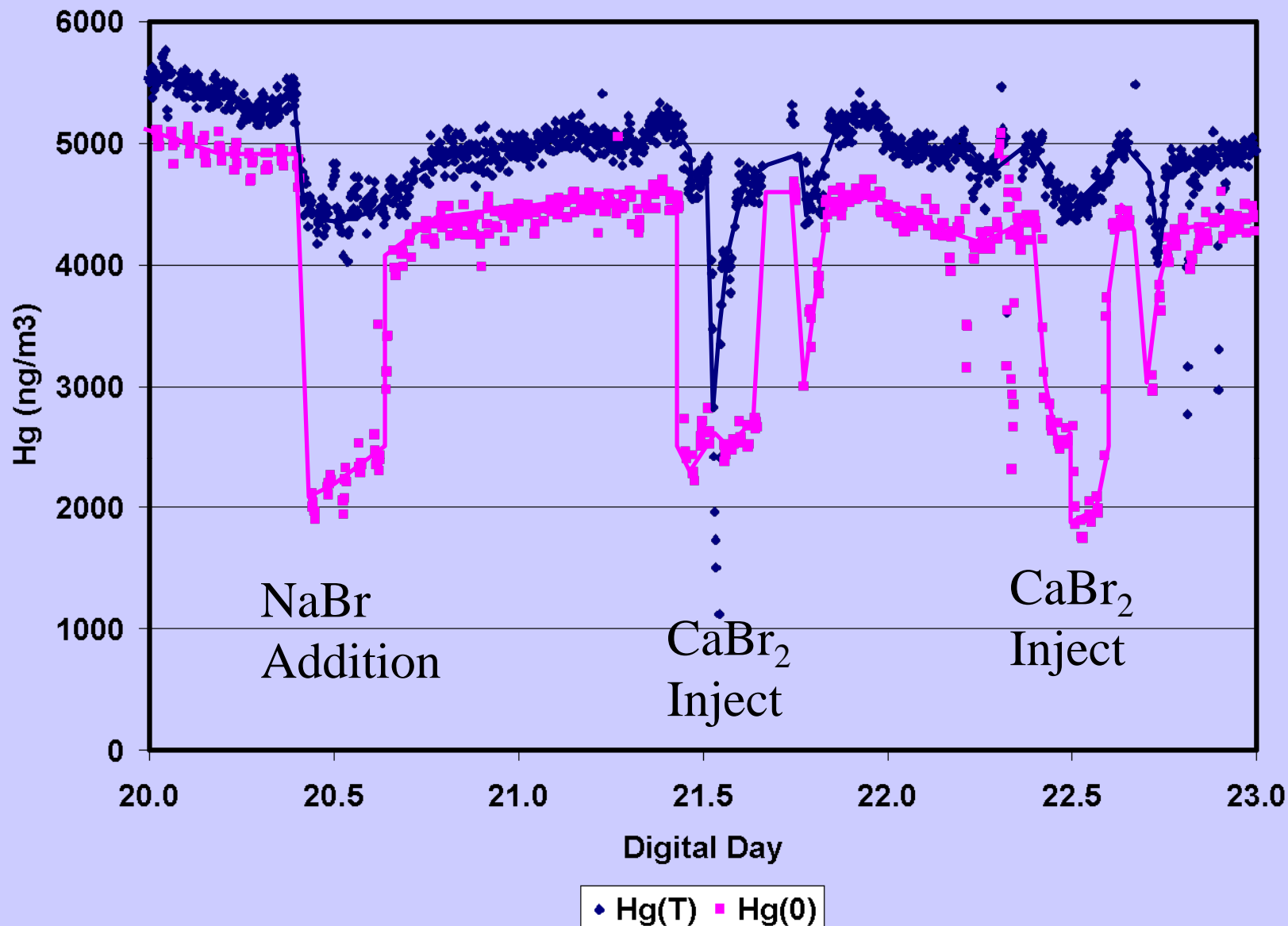


Various Hg control tests at Minntac (Line 3)

Standard Pellets



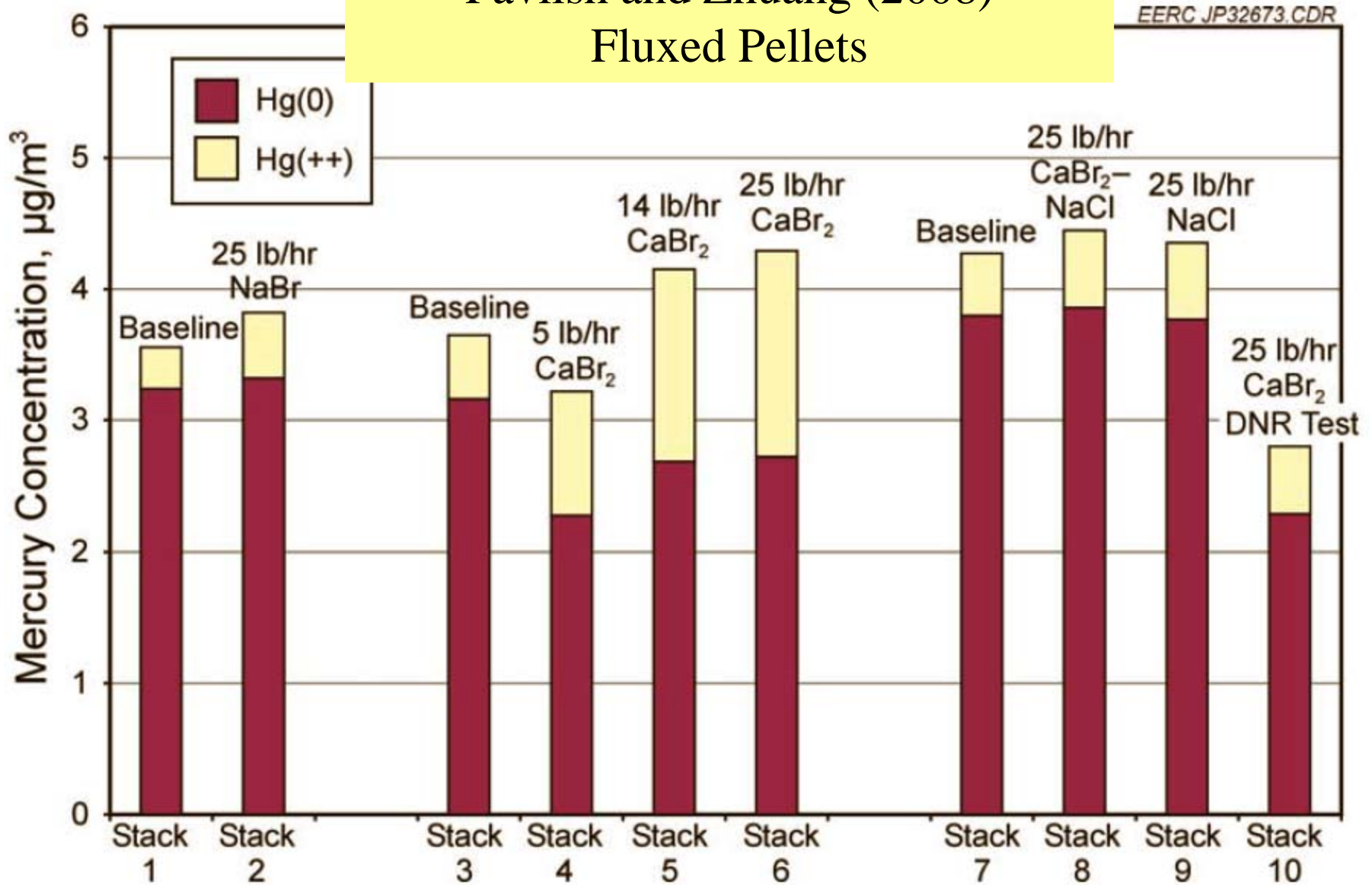
Br addition and injection tests at United Taconite





High Energy Dissociation Technology
(HEDT) prototype (Pavlish and Zhuang, 2008)

HEDT Test Results at Minntac - from
Pavlish and Zhuang (2008)
Fluxed Pellets



Summary

Variable responses observed for Br:

Oxidation without capture

Oxidation with limited capture

Oxidation with capture and long residual effect

Scrubber reactions are important:

Fe-Oxides – lose ability to adsorb Hg^{++}

Cl, Br – high concentrations oppose capture

SO_2, NO_x – interfere with NaClO_2 addition

On going studies (2009)

Grant Dunham, EERC: Bench Scale Tests for Fixed Bed Capture of Mercury.

John Pavlish and Ye Zhuang, EERC: Br-Corrosion Testing of Grate Materials.

FUTURE

2009 - Industry Led Hg Research Effort

- (1) Conduct medium and long-term tests by 2013.**
- (2) Begin full-scale installation (one furnace) in 2014.**
- (3) Provide full implementation schedule by 2016.**
- (4) Reduce Hg emissions to 210 lb by 2025 (This is a 75% reduction).**



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Thank you!

